ART. VIII. — *The Botanical Text-Book for Colleges, Schools, and private Students; comprising, Part I. An Introduction to Structural and Physiological Botany. Part II. The Principles of Systematic Botany; with an Account of the Chief Natural Families of the Vegetable Kingdom, and Notices of the principal Officinal or otherwise Useful Plants. Illustrated with numerous Engravings on Wood.* By ASA GRAY, M. D., Fisher Professor of Natural History in Harvard University. New York: Wiley & Putnam. Boston: Little & Brown. 1842. 12mo. pp. 413.

WE share largely in the gratitude, with which students of nature are greeting this work of Professor Gray. Botany is a study, to which we have owed much of the pleasure of life. Many a pleasant summer has it made pleasanter for us. When worn with labor, or sick with care, or wearied with the din of business and the turmoil of politics, we have found nothing so refreshing and restorative to spirit and body, as a stroll of as many days or weeks as we could spare, through the rich and variegated old forests, and the pleasant interior towns, of New England. Some botanical guide, — Bigelow or Park, or Beck or Darlington, — has enabled us to add annnally to the number of our vegetable acquaintance; and some philosophical friend, like Linnæus, or Smith, or Decandolle, has helped us to understand what we saw, and to enjoy it the more in consequence. Of late years Torrey and Gray have been welcome companions, leading us both to names and to things. We have always returned with a deeper sense of the beauty there is in the world of nature; of the wisdom, of which that beauty is the external decoration; of the resources which awaited us when the time should come, if it should ever come, when we should be able to go off into the country and not come back till we were ready. Such pleasures, so real, so constant, so pure, so inexhaustible, we would gladly see becoming more common; and we therefore welcome, with lively satisfaction, a work which will have the effect of recommending them to every one who will read it.

The work is very properly inscribed to the author of the "Florula Bostoniensis," as the individual, who has done

more than any other native of New England to advance the study of this enchanting science, and who, had he not had the misfortune to become eminently successful in the lucrative practice of medicine, might at this day have been giving lectures on Botany, filling the chair in which Dr. Gray now sits, and teaching the doctrines of the natural system in some volume or volumes, as good perhaps as the one before us, and with the same skill with which, — it is now thirty years ago, — he brought the lovers of botany to be followers of Linnæus.

Before the appearance of Dr. Bigelow's "Florula," the uneducated student of botany could have found no guide to the names, much less to the properties, of the common plants about him. Whatever might be his genius, he could make no discoveries. All was unknown; no one could tell him what was new. No tolerably full catalogue of New England plants had been made. Dr. Cutler, in a paper inserted in the second volume of the "Memoirs of the American Academy," had described a few of the plants of Essex County. Visiters to this country, and observant persons among the settlers and residents, had sent specimens to Linnæus and other scientific men abroad. These had been summarily described. The elder Michaux, with a power of observation which few things escaped, had traversed this country from north to south, and, on his return to France, had given descriptions of a surprising number of new plants. Professor Peck had visited the White Mountains, and had botanized extensively on the banks of the Piscataqua, and in the neighbourhood of Cambridge. He corresponded with some of the best botanists in this country and in Europe. His plants were lying, carefully named, and nicely ticketed, in his *herbarium* at the Botanical Garden in Cambridge; and some rare ones had been transplanted into the garden and they are there growing to this day; but they had got no nearer the world, for this excellent botanist was as modest as he was learned. Frederic Pursh had bivouacked, shot birds, gathered plants, and drunk brandy in New England, on the lakes, in Canada, and at the south, and had carried back to England a large collection. The descriptions of these had not yet appeared. And, if they had, what were the country gentlemen and gentlewomen of New England to learn of its botany from the French of Michaux, or the Latin of

Pursh? In this state of things, the "Florula" first made its appearance.

What a help that book was, and has been, up to this day, to all who have begun to become acquainted with our native plants, no one who lived before its publication needs to be told. It has helped us to their names. The "Medical Botany" of the same writer has been a most valuable contribution to a knowledge of their properties. It was peculiarly proper, then, that the first native treatise upon Structural, Physiological, and Systematic Botany, should be dedicated to the author of these two works.

The first part of the "Botanical Text-Book" gives a sufficiently full, and perfectly clear account of the principles of the structure and physiology of plants, with the most important of the facts which have been observed up to the present time. To these an interest is imparted, altogether greater than belongs to mere description, by the introduction of some remarkable laws. Even of the more striking of these, we shall be able to give only a rapid and inadequate account.

It has been long known that the great mass of the structure of a vegetable was made up of cellular tissue, (that is, little bladders or vesicles, cohering together by their sides,) of ducts, and of spiral vessels or tubes. Through them, or some of them, sap was known to circulate, — to be drawn up, by some unknown power, by the roots, and carried thence to the remotest extremities of the leaves. The question has been, What is the power by which a large quantity of fluid is thus constantly, and pretty rapidly, carried to such heights? This question seems to be solved, at least the difficulty is carried one step farther back, and many of the facts are reduced to a general law, by the curious discovery made by Dutrochet, which he calls *exosmosis* and *endosmosis*, and which itself seems but a partial expression, — a single form, — of a more comprehensive law, which will have its full explanation in the principles of electricity.

"Roots increase in length entirely, or chiefly, by the addition of new matter to their lower extremities or points, extending very much in the same way as an icicle; except that the new matter, constantly deposited in layer over layer upon its youngest extremity, is supplied from within and not from without,

The points of growing roots, composed of recent tissue, are therefore very delicate and easily injured. Like all newly-formed vegetable matter, they are extremely hygrometrical, and absorb with great rapidity any fluids presented to them. It is by these extremities, called *spongioles* or *spongelets*, that absorption by the root almost exclusively takes place. This power which roots possess of continually adding new living matter to their extremities, enables them to penetrate the solid earth in which they grow, to insinuate themselves into minute crevices, and to extend from place to place, as the nourishment in their immediate vicinity is consumed." — p. 26.

This is a most remarkable power. It is like that of the wedge in the hands of the mechanic. A lad, by small repeated blows with a light hammer, inserts a set of small thin wedges into holes drilled along the side of a mountain quarry. A single blow seems to produce no effect. He has patience, and in a day, or part of a day, a mass of many feet in every dimension is rifted from the solid rock. The delicate terminal spongelets of a tender root, so delicate that the slightest touch will wound them, insinuate their newly-formed cells between the particles of dense earth and gravel and stone, make their way, expand, enlarge, and at last the roots lift up a vast mass of earth on every side of the trunk.

"If the lower end of an open tube, closed with a thin membrane, such as a piece of moistened bladder, be introduced into a vessel of pure water, and a solution of sugar in water be poured into the tube, the water from the vessel will shortly be found to pass into the tube, so that the column of liquid it contains will increase in height to an extent proportionate to the strength of the solution. At the same time the water in the vessel will become slightly sweet; showing that a small quantity of syrup has passed through the pores of the membrane into the water without, while a much larger portion of water has entered the tube. The water will continue to enter the tube, and a small portion of syrup to leave it, until the solution is reduced to the same strength as the liquid without. If a solution of gum, salt, or any other substance, be employed instead of sugar, the same result will take place." . . . . .

"Now, as these phenomena appear to be universal, the porous spongelets, or extremities of the root, may be taken to represent the membranous or porous partition between the sap in the root and stem, charged with the gummy, starchy, or sugary matter it has there dissolved, thus increasing its density, and the much less

dense fluid which reaches the rootlets from without; in which case the latter ought to enter into the root and stem, as in fact it is found to do. And it should continue to flow into the plant, until the sap in its tubes and cells is reduced to the same density as that of the liquid in the soil to which the rootlets are exposed. This can never happen, however, in a growing plant, where the sap is continually and greatly concentrated by exhalation from the leaves; and consequently, the flow of the sap into the roots, and upward towards the more concentrated portions, ought to continue during the growth of the plant. Whatever other influences may be concerned in the ascending circulation, it cannot be doubted that Endosmosis, combined with exhalation from the leaves, will almost suffice to explain the facts." — pp. 75–77, *note*.

And not only will it explain the flowing of the sap into the roots, but its transmission from cell to cell, throughout the whole extent of the plant.

Thus, one after another, are the secrets of nature laid open to us.

Another of the striking general laws is, that which is expressed by the poetical and we think unphilosophical phrase *vegetable metamorphosis*. It was an idea of Linnæus, expanded and distinctly announced, but at the same time perverted, by Wolf and the poet Goethe, that, to use the language now employed, every appendage of the plant, the leaves of the calyx, the petals of the corolla, the stamens and the pistils, are *transformed leaves*. The recognition of the truth which lies under this expression, and the adoption of the theory built upon that truth, have undoubtedly "given a new aspect to botany, and rendered it one of the most philosophical and inductive of the natural sciences." The great importance of the truth we admit. We see and admire the consequences drawn from it. We object to the language in which the truth is expressed. On the seventeenth page, our author says;

"A flower, therefore, being the *transformed extremity* of a stem or branch which has ceased to elongate, terminates the stem which bears it, or prevents its growth in that direction."

We object to this mode of stating the truth. It makes the production of the flower and fruit the effect of accident. As if the great end in view, in the structure of plants, were

the production of leaves only. It would be more true, and therefore more philosophical, to consider the seed as the end, towards which, through the fruit, the flower, and the leaves, nature is always aiming. This is obvious, from the fact, that the seed, — the fruit in some form, — is the only thing which, in the higher plants, is constant. The leaves are sometimes wanting; sometimes the calyx; sometimes the corolla; sometimes both; sometimes every stamen but one, and every pistil but one. The seed, the fruit, is never wanting. It would be better, therefore, to state, what is clearly the fact, that the great end, towards which every thing in the vegetable structure is subservient, is the production of the fruit. But the law of vegetable structure is a simple law. One principle or law of structure is visible in every appendage and organ of the plant. The rudest form in which this law is observable, is in the seed-leaves of the embryo, in those thick leaves of the bean, for example, which we see expanding just above the surface of the ground in the newly risen plant, and contributing to its nourishment. In a form hardly more perfect, it may be observed in the tough and leathery scales, which, in our climate, enclose most buds, and guard them from the assaults of the elements. It shows itself more perfectly, and in its most common state, in the leaf, which has an upper and an under surface, each performing its peculiar functions, and a double circulation, by which the sap is brought up and exposed to the influence of air, light, heat, and electricity, its superfluous portions are thrown off, and, by processes whose hidden mechanism we can only conjecture from their effects, it is converted into that nourishing fluid, from which are formed wood, gums, resins, sugar, and every thing else derived from the vegetable creation. It assumes higher forms in the calyx and corolla, and performs a higher, perhaps, but an imperfectly known function in those forms. In the floral organs, in the stamens and pistils, an analogous organ, by the same law, fulfils a still more important office, — how, we know not, — but we know, that we can sometimes, when the work is done on a scale suited to the grossness of our imperfect faculties, perceive similar surfaces with similar structure and similar office. But the organ and the law culminate, they are exhibited in their most perfect form, in the fruit. The law is one, in all these varying forms. But it is only of late, that

this law has been perfectly detected, that an enchanter has come, powerful enough to compel the Proteus to reveal himself, — one and the same, in all his multitudinous changes.

The truth is, we want a comprehensive, philosophical term, to include leaves, bracts, sepals, petals, stamens, and styles. There is the greatest objection to calling the latter transformed leaves. If we feel ourselves at liberty to conjecture, what was the original plan of the Creator, in the structure of what we call perfect plants, we cannot doubt, that stamens and pistils are as essential a part of that plan, as true leaves ; and it would be just as correct to say, that leaves are transformed or imperfect stamens or petals, as to say, that the latter are transformed leaves.

It is remarkable, that this important law is not only most distinctly laid down by Linnæus, but it is more correctly and philosophically stated than it has been, so far as we know, by any of those, who have flattered themselves, that they have had nearer views of the secrets of Nature, than this great original interpreter of her laws. The passage in the "Philosophia Botanica," as quoted by Dr. Gray, is the following ;

"Principium florum et foliorum idem est. Principium gemmarum et foliorum idem est. Gemma constat foliorum rudimentis. Perianthium sit ex connatis foliorum rudimentis." — *Philosophia Botanica*, p. 101.

The word *principium*, as it was used by Newton, and the other learned contemporaries of Linnæus, and as it is used here, means precisely what we now express by a *law*. The passage may be, therefore, translated, —

"The law of structure, in flowers and leaves, is one. In buds and leaves, it is one. A bud consists of the rudiments of leaves. A perianth (or calyx) may be (*considered as formed*) of the rudiments of leaves grown together."

Thus, in this passage, we see not only the great law in question distinctly stated, but, in the last sentence, we have more than an intimation of another most important principle, which has necessarily a large place in this and other elementary treatises, — that the simplicity and symmetry of structure are often disguised by the growing together of contiguous parts.

Thus, however it may be expressed, one comprehensive

law, — now made distinctly visible, and beautifully, though rapidly, laid down in this volume, — pervades the structure of all the appendages of a plant. Another law, not less remarkable, regulates their position or insertion, and order. "The ascending axis or stem is, from the first, a *bud*, that is, a tender growing point, surrounded and protected by appendages, ... arranged in a determinate order, and which, as the axis itself elongates, developes into leaves or some modification of leaves." A bud is, or may be, formed in the axil of each leaf, that is, just above the leaf, in the angle between it and the stem. These buds are developed or remain inactive, according to circumstances. "When developed, they produce branches, organized like the parent stem;" "but they are capable of independent existence, as we see in the case of offsets, cuttings, &c., or of effecting a union with the stem of a plant of a different species, as happens in budding and grafting." Leaves spring from the stem at certain fixed points. "At these points there is a more or less evident change in the tissue of the stem, the fibres and vessels being interlaced horizontally, some of them passing into the leaf; while, in other parts of the stem, they are vertical and parallel. These portions are called *nodes*. One leaf may arise from each node, or two placed opposite, or three or more placed in a ring around the stem." "Since all regular buds are either terminal or axillary, the arrangement of branches depends upon that of the leaves, and upon the number of buds, that are developed." When only one leaf rises from each node, they are said to be alternate, and the branches are also alternate. If the leaves are in pairs, opposite each other, the branches will be opposite.

"Alternate leaves are seldom placed one above the other on exactly opposite points of the stem; but the second leaf will be found to arise a little to the right or left of the opposite point, and the third, a little on one side of the perpendicular to the first; so that, in the apple and pear tree, it is only when we reach the sixth leaf, that we find one placed exactly over any of the five preceding. The sixth, in this instance, is found to be inserted directly over the first, the seventh over the second, the eighth over the third, and so on. Consequently, if we take a branch of an apple tree, and trace a line connecting the bases of the leaves, a regular and simple spiral will be formed. This spiral arrangement of the leaves, variously modified in different plants, but

remarkably constant in the same species, is of general, if not universal occurrence. It is not so obvious, when the leaves are placed at considerable distance from each other, and the branch is small in proportion, as in the instance we have mentioned; but it is perfectly apparent, when the leaves are close, as in the pine, the pine-apple (where the spires are in several series), and especially in the Pandanus (cultivated in some of our conservatories), which is actually named *Screw-Pine*, on account of the striking spiral disposition of the leaves. This arrangement is a beautiful provision for securing the symmetry of the branches; for, since the wood is formed of fibrous matter descending from the leaves, if these were not placed in regular order, over every part of the circumference, more wood would be deposited on some sides of the stem than on others. . . . . . The number of turns required to complete the spire, the number of leaves in each turn, and of the series of the spires (whether simple, double, triple, &c.) vary greatly in different plants. The spiral arrangement extends to all parts which are modifications of leaves." – pp. 62, 63.

"The flower being a transformed branch, each row or set of organs is a whorl or ring of leaves, which have undergone a peculiar metamorphosis." — p. 101.

"A complete, perfectly regular, and symmetrical flower should, therefore, consist of four whorls of an equal number of parts, alternate with each other. If the calyx be composed of five sepals, the corolla should consist of five petals, alternate with the sepals; the stamens should be five in number, alternate with the petals; and the pistils, also, five in a single whorl, alternate with the stamens. Such a flower being assumed as the *type*, or pattern, all the various diversities, which the nearly 80,000 described species of flowering plants exhibit, should be reducible to this typical or *normal* state, and the nature and causes of their deviations duly explained. The doctrine of vegetable metamorphosis, therefore, as applied to flowers, and to the discovery of their true structure and symmetry, when this is more or less masked or obscured, constitutes a most interesting portion of the botanist's investigation; indeed, the study either of organography or systematic botany cannot be intelligently prosecuted without it. The application of this theory, like the touch of the spear of Ithuriel, causes the most anomalous structures and disguised forms of vegetable organization to reveal their typical state and primitive character." — pp. 106, 107.

There are few things in physical science, — there is nothing in natural history, — more beautiful, than the application of

this twofold theory of structure and symmetry of arrangement to all vegetable forms. It is the thread of gold, on which the pearls of this fascinating science are strung. Facts, which before were distinct and solitary, now are seen to be naturally allied; they easily fix themselves in the memory. They arrange themselves in lines, which, without effort, we survey at a distance. Before the adoption of this theory, the young student of botany felt as if he were wandering in a labyrinth. The objects were new and beautiful, but confused and bewildering. There were guide-boards which he could not read, and paths which led, he knew not whither. Under the guidance of this theory, he walks as through a garden. He sees his way clearly before him, and vistas open to charming prospects on every side; and, when he has reached the end, he finds himself on an elevation, from which he looks back upon his whole course, and traces every winding and every irregularity in his path.

The chapter on the food and nutrition of plants, is full of suggestions of the greatest practical importance. The delicate analysis of the chemist has shown the essential constituents of all plants. These are carbon, hydrogen, and oxygen. Another element, nitrogen, though not obtained from the analysis of the tissue of plants, is always present in growing organs, and is an essential constituent of a large number of vegetable products. Various mineral substances, alkaline, saline, and siliceous, are invariably found in the ashes of certain plants and products of plants. They must be derived from the air or the soil, and they must be introduced into the plant dissolved in water. The ingredients of a soil must, therefore, be soluble, otherwise it will be barren; and something must be mixed with the soil, to render them soluble. The universal food of plants is water, holding in solution always carbonic acid, which it derives from the atmosphere, and nitrogen, either simple or in the form of ammonia, and sometimes the alkaline and earthy salts, which it derives from the soil. By the analysis of the ashes, it is found, that different plants, a pea, a bean, and a stalk of wheat, for example, abstract from the soil alkali, as well as silex, in very different proportions.

"If they be allowed to produce fruit and ripen their seeds, the latter will be found to contain, in the wheat, a considerable

quantity of phosphate of magnesia, &c., but in the pea and bean scarcely any. It is therefore apparent, that, while a crop of wheat robs the soil of certain alkaline and other inorganic matters necessary to its proper growth, peas and beans leave these substances almost untouched. This explains the utility of the latter, as fallow crops, since they add to the land a portion of the carbonaceous matter they have derived chiefly from the air, while they scarcely diminish its alkalies and phosphates, which are required for the succeeding wheat crop. These alkaline and other constituents of the soil, it may here be remarked, are derived from the slow disintegration and decomposition of the rocks and earths that compose it, or are added in the form of manure.

"The amount or proportion, as well as the kind of earthy matter, is nearly constant in the same species, when grown in widely different soils; provided, that the substances which the plant requires are present in the soil at all. When this is not the case, its growth is checked, or it fails to ripen its fruit or form its peculiar products, and eventually perishes. One alkaline base may, however, sometimes take the place of another; as when a plant, which requires potash or magnesia, supplies itself with soda or lime, when the former is not accessible.

"It being, therefore, indispensable that a plant should find in the soil the mineral matters necessary to its growth or perfect developement, we are enabled to understand, why various species will only flourish in particular soils or situations; why plants which take up common salt, &c., are restricted to the seashore and to the vicinity of salt-springs; and why pines and firs, the ashes of which contain very little alkali, will thrive in the thinnest and most sterile soil, while the beech, maple, elm, &c., abounding with potash, are only found in strong and fertile land. These facts constitute the basis of the whole theory of manures; which consists in supplying artificially to the soil, the elements, which the particular plant in cultivation especially requires." — pp. 70, 71.

Nitrogen is an essential constituent of many seeds, particularly of those grasses, which are cultivated for grain. Those manures which furnish ammonia abundantly are, therefore, the most proper for these most important cultivated plants.*

---

* A striking instance of the light thrown on the processes of agriculture by the investigations of the chemist, is given in a late excellent "Address before the Massachusetts Horticultural Society," by their accomplished Secretary. See pp. 14, 15.

The essential elements are formed, in plants, into gum, starch, and sugar, which have each precisely the same constitution as sap; and, what is still more striking, the substance of which the cells, the vessels, and the woody fibre of plants consists is composed of the same constituents, in the very same proportions.

But to mention the curious and useful facts presented in this chapter would be to quote the whole of it. The subject has not, to our knowledge, been before presented to the English reader in a form so clear and at the same time so concise.

The reproach has often been cast upon parts of natural science, and upon botany among the rest, that it teaches only names, and is mere barren and unprofitable speculation. The present state of botany, as exhibited by this volume, takes away this reproach. It is full of practical results. The observations and reasonings of students of nature have been long and gradually maturing. They at last bear fruit. Such has been, so many times, the course of philosophy, that we shall not be surprised, if, at no very distant day, the faint murmurings of the discontented and distrustful objectors shall altogether cease.

When Franklin was first raising his kite to the clouds, it was natural that boys and boyish men should laugh at him. When he protected the habitation of man from the thunderbolt of heaven, even philosophers were filled with astonishment. And he, who had disarmed the thunder, won respect for himself and his country in the two first courts of Europe. When Jansen amused himself and his children in fitting spectacle glasses to tubes, the children, and even he, thought it was only very pleasant sport. When Galileo, by his newly invented telescope, suggested by the play of Jansen's children, pointed out a mode of calculating the longitude, the merchants of Florence must have looked upon the matter as something for men to think of; and Cardinal Frederic Borromeo must have humbly rejoiced at the prospect of feeding his starving poor, in a future season of scarcity, with wheat from distant lands.

A peculiar distinction of the natural system is the importance which it attaches to whatever relates to the embryo. This is a direct consequence of the matured views of the nature of the embryo, and of the fact that it possesses, "in a

rudimentary or undeveloped state, all the essential organs of vegetation, namely, a root, stem, and leaves."

The nature of the plant is, in a measure, predicted in the embryo; and it is found, that distinctions, drawn from an examination of this important organ, lead to great divisions in plants, which are confirmed by their whole aspect, habit, structure, and growth; and almost uniformly coincide with the divisions which are made by the common observation of mankind, and are indicated by their language. The embryos which are furnished with two cotyledons, or rudimentary leaves, expand these two leaves on the surface in the just-risen plant, with the plumule or growing point between them, as is the case with most plants common in our climate. Those that have one cotyledon, leave that below the surface, and send up one leaf formed of the plumule, as we see in maize and wheat. While the dodder, which has no leaves at all, is distinguished for having an embryo without a cotyledon; and, in this instance, the spiral embryo seems to foreshow the climbing habit of the plant.

The object of the second part of the work is the examination of the systems, by which plants are conveniently distinguished and arranged, particularly of the two most important ones, the artificial system of Linnæus, and the natural system.

"The object proposed by the natural system of botany, is to bring together into groups those plants which most nearly resemble each other, not in a single and perhaps unimportant point (as in an artificial classification), but in all essential particulars; and to combine the subordinate groups into larger natural assemblages, and these into still more comprehensive divisions, so as to embrace the whole vegetable kingdom in a methodical arrangement. All the characters which plants present, that is, all the points of agreement or difference, are employed in their classification; those which are common to the greatest number of plants being used for the primary grand divisions; those less comprehensive for subordinate groups, &c.; so that the *character* or description of each group, when fully given, actually expresses all the known particulars in which the plants it embraces agree among themselves, and differ from other groups of the same rank. This complete analysis being carried through the system, from the primary divisions down to the species, it is evident that the study of a single plant of each group will give a correct (so far as it goes) and often a sufficient idea of the struc-

ture, habits, and even the sensible properties of the whole." — p. 191.

In the opinion of those best acquainted with it, botany has now reached the state when a natural system may be employed by the learner, for the purpose of finding out, first, the names, and secondly, from them the properties of plants, and their natural affinities. The two things are completely distinct. No one, who knows any thing of the natural system, can for a moment doubt, that it offers the only satisfactory mode of accomplishing the last of those two objects. But as to its being fitted to accomplish the first, so fully and easily as the artificial system has done it, we must, for the present, be allowed to entertain doubts. We are among those thousands, who, with no other help than Bigelow's "Florula," have, almost always without difficulty, found out the names of most of the common plants of New England. Why should a system, which has been so convenient and so useful, be suddenly discarded? Dr. Gray places the matter in its proper light when he says,

"The immortal Linnæus, finding it impossible in his day to characterize the natural groups which his practised eye detected, proposed as a temporary substitute, the elegant artificial scheme which bears his name. As this system is identified with the history of the science, which, in its time, it so greatly promoted, and as most systematic works have until recently been arranged upon its plan, it is still necessary for the student to understand it."

And why not to use it? A beginner is just as ignorant of botany now, as he could have been in the time of Linnæus. Just as much now, as then, he wants, first of all, to know the name of a plant; and he wants to find it out in the easiest way possible. The accomplished botanist may, without inconvenience, dispense with the Linnæan system. The fortunate few who have access to a botanic garden, a rich herbarium, books of figures, and the aid of a learned teacher, like Dr. Gray, may easily dispense with it. But how is it with the multitude of lovers of nature, scattered in the small villages, among the woods and hills, throughout the land; who have little leisure, who can afford but a single book, who can have no means of dissection, and know not an individual to tell them the name of a wild flower? To such, Torrey and Gray's admirable "Flora" is utterly unintelligible.

While thousands of such have derived unmeasured delight from the scanty knowledge they have gained, by the help of Bigelow, from an acquaintance, however slight, which they have formed with the vegetable denizens of a limited region around them. It is true, that from the artificial system they get no very great knowledge of affinities and properties, and but little of structure. They are only put in a state to receive with avidity this kind of knowledge. But it is not true, that a person who is familiar with the names, habits, and appearances of five hundred plants, however he may have learned them, is altogether ignorant of botany. He must have a very considerable acquaintance with the very characteristics which Robert Brown himself would have to notice, to enable him to distinguish the same plants. Why not, then, continue to employ, for the benefit of the great mass of the ignorant, a mode of finding the name which has answered this purpose so admirably well ?

We have no doubt, that an introduction to the natural system can be framed, which may take the place of the artificial. The beautiful "Flore Française" of Decandolle proves that it can. But we greatly doubt, whether even that answers the purpose so perfectly as the Linnæan system. We know not how it may be, but we doubt, whether it is as common in France for farmers' sons and village school-mistresses, with no education but that of the common schools, to have picked up a knowledge of botany, as we know it is for the same sort of persons in New England.

Such an introduction, however, may be made ; and, if any one can make it, it is the author of the "Botanical Text-Book." Hitherto, it has not, so far as we know, been done in the English language. The artificial analysis in Lindley's "Introduction" makes but a distant approach to it. The "Artificial Table," at the end of Lindley's "Ladies' Botany," comes nearer, but is by no means full enough. Indeed, the plan of that work did not require it. Of late we hear, that Hooker's "English Flora" has assumed a new form. The staunch Linnæan has at length yielded, it seems. We shall look anxiously for new evidence of the feasibility of the project ; for, with all our old and warm prejudices in favor of the Linnæan arrangement, in a Flora for daily and common use, we shall heartily rejoice to be assured, that it can give place to something better.

We intended to examine somewhat fully the second part of the "Botanical Text-Book," but we have not space. We can only say, that it is carefully and skilfully done, and that about one third of the orders, the more important or more difficult ones, are illustrated by neat, well-designed and well-executed figures from wood engravings. We had thought of much to say of the value of the work to the gardener and farmer, the teacher, and the general student. But for all these we must refer to the work itself. We cannot avoid indulging the hope, that it is destined to be the means of introducing to the lovers of nature amongst us, a higher and more philosophical form of the now noble science of botany. The prevailing conceptions of it have been wholly inadequate. It has, in consequence of the almost exclusive use of the Linnæan method, been considered as little more than a mode of getting at the names of plants. This book puts within the reach of thousands the enlarged views and vast and exact knowledge of the Jussieus, of Linnæus, of Richard, Decandolle, and Robert Brown, men who deserve to be known to common fame, as among the greatest observers and most original thinkers of the last hundred years.

We congratulate the friends of natural science upon the election of a person of so much zeal and ability as this book discovers, to the chair of botany in the University of Cambridge. We still more warmly congratulate the Professor himself, at being able, at his age, and with his tastes, to devote his time, attainments, and powers to such pursuits. The position offers enviable advantages to the votary of this delightful science. France, England, and Germany, with their strongly marked peculiarities and their deep researches, lend him all their aid. He has no national jealousies to prevent him from receiving whatever they can offer. He stands on the edge of a wilderness almost unexplored. Nature here assumes new shapes. No province of the mighty realm is fully conquered. Like Cæsar, he can command the veterans of the old world. More fortunate than Alexander, he has a new world offered to his victorious arms.